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FENCE POSTS

and Other Wood Treatments for the Farm



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FOREWORD

Fences are made to frame and control the farm according to the farmer's plan. Good, low-cost fence posts are the principal means by which a plan of diversified farm management and operation are staked firmly to ground.

Good, naturally durable posts are scarce in many regions and are becoming more expensive. The purpose of this circular is to tell how to make good posts of the more abundant saplings. It is of first importance to learn better methods of making use of available woodland resources, and any processes used which are beneficial to the farmer.

No single treating method has been found satisfactory for all species, all wood materials, or for all farms. Simple methods and preservatives, therefore, are explained to meet a variety of problems and conditions.

Here are the principle methods for treating fence posts: end-flow, soaking or steeping, and hot and cold baths, or combinations of these methods. Simple end-flow methods of treating posts are emphasized and explained in this publication.



THE COVER: Live oak posts and moderately durable woods require treatment at the ground ends only. Shown inspecting live oak posts produced by the cooperative farm saw-mill are R. W. Snyder of the Extension Service staff, J. C. Yeary, Fayette County agricultural agent, and E. A. Randolph, Negro county agricultural agent of Fayette County.

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FENCE POSTS

and Other Wood Treatments for the Farm

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Replacements of untreated fence posts in Texas are made at the rate of over one-half post per acre of farm land yearly—more in humid, damp sections. Since post woods are no longer abundant in some sections many sapwood posts

of only one to two-year life service in the humid region are being placed in fences. Durable heartwood cedar posts distributed widely over the state from Central Texas are less abundant and more expensive. Most of the posts used in the east portion of the state have been split from nearby saw-timber-size trees, usually post oak or other white oaks, which last about five or ten years.



Good heartwoods and thoroughly treated sapwoods assure long service.

Cost of concrete and steel posts or pressure treated woods is much higher than the farmer is accustomed to paying for good, naturally durable woods.

Good Home Treatments Preserve Posts

The most durable woods, or those given good home treatments, may serve for ten to 20 years or more. At little cost of treating carefully the more abundant non-durable sapling posts, life service may be increased three or more times and at a proportionate saving of labor and money.

Sound wood should be strong enough to support a fence, but it also should resist decay, termites, and borers for many years. Life service of a small, home-treated post, about three inches middle diameter inside bark, may be five, ten or 15 years, depending on thoroughness of treatment and preservatives used. Farmers need a good five-cent post. The Agricul-

tural Experiment sub-Station at Nacogdoches and the Forest Products Laboratory where posts have been treated for many years advise the use of larger posts, especially for loose soils.

Tree stems have a taper, and when a sapling is cut into round posts and treated, the butt ends have more strength, more bearing surface in the ground, and more treated wood for the ground end than split posts of a given size. Any sawed post should be tapered. Some of the large fence line posts should be strong enough for corner and gate posts and must have a strong cross cleat about three inches thick by 12 to 18 inches long, fastened near

the butt end to prevent lifting. Another cleat or a rock should be placed higher up to give the anchoring posts greater bearing against the top soil.

Saplings for Posts

Wise timber use best determines timber values and conserves timber best. Thickets fringing the farm woodlands always will be im-

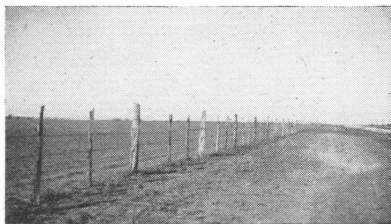


Shown here are tall, fast growing willows. It is estimated that about 2000 posts per acre can be cut, barked and treated by any simple method and with any preservative.

portant to some desirable forms of wildlife animals, birds, and plants. Fire lanes, light and frequent thinnings and prunings make forests and trees more resistant to destructive agencies of all kinds and improve the quality and growth. Woods grazing may reduce interfering vegetation and also make the woodland fireproof if begun early enough.

Thining for posts can start early. Therefore, the possibility of a practical home preservative treatment of posts and poles from trees of any species gives the farmer an early start at profitable use and management of his timber patches.

Practically all regions have woods suitable for preservative treating. Salt "Cedar", known also as Tamarix, is a small non-dur-



Good cedar posts and stays are bark-peeled to increase resistance to fire.

able sapling common along the lower Pecos and Rio Grand River Valleys and grows prolifically as a shrub. It reaches average post size along banks and wet wastes next to irrigated areas and serves many purposes where wood is scarce. Preservative treatment can make it a low cost post wood for the region. Small poles such as this or willow are double layered for culverts or bound in bundles for stronger supporting posts, erosion control construction, etc.

Cedar break areas of the state have acreage more suitable for combined use and production of livestock, wild life, and posts. Overcutting of the best cedar on poor land and widespread clearings for more productive range use on the best soils leave poor sites for production of poor quality posts. Trees are likely to be smaller with a small proportion of sapwood. Non-treated sapwood cedar posts with shaggy bark are easily destroyed by fires and decay but the pipe and drum treatment makes the wood more resistant.

Trees With High Proportion of Durable Heartwood

Dark-colored heartwood, characteristic of bois d'arc, black locust, red mulberry, mesquite, cat-

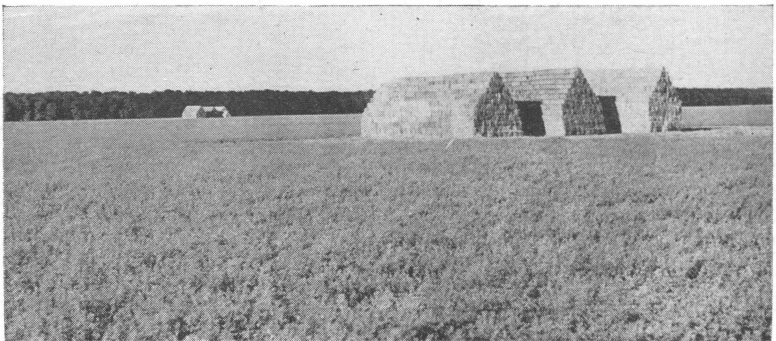
alpa, and cedar indicates a durable post wood. No preservative is needed if the heartwood is well-developed. Light brown-heartwoods of post oak, live oak, and other white oaks, also chinquapin, and sassafras are less durable, hence larger posts with some sapwood preservative treatment should be used especially for ground ends. The most durable species as well as chinquapin and sassafras reach only small tree size except under favorable conditions, but they develop a high proportion of durable heartwood at an early age. The strong and durable lumber of the large trees and the more abundant post oak and live oak of farm sawtimber size are excellent for outside uses.

West and Central Texas have forty-five million acres of bushy mesquite. Many are large enough for fence posts. Mesquite posts are seldom straight and are heavy, making them difficult and expensive to haul. Sapwood of mesquite posts is quite vulnerable to insect borers. Damage is reduced considerably if the posts are bark-peeled, allowed to dry rapidly and

case-hardened by exposure to hot sun. After the bark-peeled posts have dried for several weeks under shade with as little case hardening as possible, they are soaked a few days in oil soluble preservative such as 5% pentachlorophenol or one-third to one-half creosote mixture with petroleum oil to penetrate the sapwood.

Mesquite heartwood is attacked to a lesser degree by borers. Since no preservative penetrates the heartwood, the thin sapwood shield must be preserved. The small amount of preservative required to penetrate sapwood and the cracks of seasoned heartwood becomes a low cost treatment for mesquite. Mesquite posts resist grass fires better than cedar. Good ones have lasted 50 to 70 years without treatment

Sapwood of any species soon decays or gives way to termites. None of our heartwoods will wholly resist termites under tropical conditions, but the most durable ones resist them satisfactorily in this state. Termites destroy the non-



In the background is one of man and earth's most valuable forests, about 100,000 black locust trees planted 30 years ago by a rancher in the subirrigated valley in the Panhandle of Texas. It gives protection to the alfalfa field from wind, shelters many wild turkey, quail and livestock. Each tree makes a strong durable pole worth many dollars.

durable woods in the ground as rapidly in the South as the wood-decaying organisms.

Farmers might profit by buying good pressure-treated creosote posts in quantities. However a majority of Texas farmers are growing many non-durable saplings or larger trees to split or saw and are more interested in low-cost pre-

servative treatments. Little use has been made of simple preservative treatments although they have been developed for decades.

Durable heartwood of any species can hardly be treated, but preservatives will penetrate the sapwood. Good decay-resistant post wood which has less than one-half to three-fourths of an inch of sapwood should not be treated.

Wood Preservatives for the Farm Described

(Information on prices, dealers, and producers of wood preservatives discussed below can be obtained from the county agricultural agent, the Extension Service, College Station, Texas, and the U. S. Forest Products Laboratory, Madison, Wisconsin.) Preservatives and treating processes are being studied, tested, and improved by chemical producers who supply free publications and instructions.

Kinds of Preservatives

Preservative treatment of wood with creosote by pressure methods is the best treatment of wood in contact with the ground. Creosote and zinc chloride have been in use as the most important preservatives for over 100 years.

There are two principal classes of wood preservatives in use: water solubles of which zinc chloride is an example, and oils or oil solutions of which creosote is an example. Water solubles treat green or dry wood and oils treat with deep penetration only thoroughly seasoned wood.

New preservatives and improved old ones which include chromated zinc chloride and borax for use

with water as a carrier offer good promise for post and other farm wood treating requirements. Pentachlorophenol, an oil solvent, is rated about equal to straight coal tar creosote when 5% of it is mixed with a petroleum, preferably fuel oil. When clear oils are used as carriers of pentachlorophenol preservative, treated wood can be dried and painted if desirable.

Pentachlorophenol, shipped in concentrated form and with oil available locally, is cheaper to use than straight creosote where the shipping cost is a factor. Mixtures of creosote and petroleum oil often are used and an equal part mixture with any oil soluble preservative should be free of sludge. Cost per gallon of straight or concentrated preservatives is too high for post treatment so the preservative must be diluted to keep the cost low enough for farm use. Petroleum oils are not toxic enough when used alone although they add a few years to the life of posts through waterproofing the wood. One concentrated form of pentachlorophenol is diluted with 10 parts of volume of light fuel oil to form the standard five per cent strength. Fuel or diesel oils, kerosene, or

other petroleum oils obtained locally are mixed with it. Five per cent solution of pentachlorophenol, like creosote, has sufficient color to show the depth of penetration if the color of the oil used is not too light. Good creosote averages about 30¢ per gallon in 55 gallon drums and the concentrated pentachlorophenol about \$1.75 in same size drums. When diluted, with equal part of fuel oil or kerosene, which cost about 8¢ per gallon, the cost per gallon of creosote-oil mixture is about 18¢ and the five per cent pentachlorophenol with 95% oil is about 24¢ per gallon, the latter being perhaps twice as good as the 50% creosote strength.

Chromated zinc chloride (18% sodium dichromate and 82% zinc chloride) has proved to be one of the most practical water soluble preservatives for farm use. This preservative is safe, clean and easy to use. Wood treated with any water soluble preservative can be painted or varnished. Zinc chloride, minus the sodium dichromate, would not be visible in the wood and may not be kept as completely soluble for use or be "fixed" as long in the wood. Zinc chloride or the chromated form with this low per cent of sodium dichromate can be used where open vat heating is desired to hasten penetration. Zinc chloride has been a few cents cheaper per pound but the chromated form is a decided improvement for simple processes: end-flow, soaking, or hot and cool bath methods. Both of the zinc chloride preservatives are acid salts and dissolve to great strengths in either hot or cold water. Often the straight zinc chloride may have a little insoluble basic salt and must

have a little acid added to dissolve it in water. Cost in Texas for zinc chloride ranges from eight to about ten cents per pound with chromated zinc chloride costing a few cents more.

Borax, (sodium tetraborate), is the lowest cost chemical used in experiments many years as a water soluble wood preservative. Its cost per pound is about four cents, less than half the cost of zinc chloride and less than one-third the cost of chromated zinc chloride. Only about four or five percent of borax is soluble in cool water which is the main difficulty in its use. This solution strength is too weak to assure many years of resistance to both termites and rot, but it may be used to treat by end-flow the more absorptive woods and above ground exposures. The solubility, however, increases rapidly in water heated to the boiling point. As the water cools the excess of the dissolved borax begins to fall out of the solution. Most treatments with borax require warm to hot water and thoroughly heated wood.

Borax is a basic salt and the zinc chloride salt or the chromated form being acid, will not dissolve together in the same water. They quickly form insoluble compounds of some of the preservatives and will not penetrate the wood. However, they penetrate the same wood separately of some woods by end-flow, i. e. one end of the post with one preservative and the other end with the other preservative. Posts have also been treated at the butt ends by end-flow with chromated zinc

chloride and simultaneously by soaking small ends in heated borax solution.

The preservatives will spread until they contact each other within the wood and form probably insoluble compounds at the point or zone of contact. Borax may not be as effective in the same strength as the zinc chloride preservative in resisting termites but has about the same poisonousness to fungi. Being very cheap a strong borax solution can be used with heat.

About one-half gallon of creosote per post may cost about 15¢. Straight creosote costs range from eight cents to 15¢ per gallon purchased in tank cars, 25 to 50¢ per gallon in drums and may be as high as \$1 per gallon purchased in small quantities. If costs exceed 15¢, an equal part mixture with a cheaper petroleum oil is advised. Thus a gallon of 30¢ creosote mixed with a gallon of

8¢ petroleum oil will cost 38¢ and should treat four posts at a cost of about nine and one-half cents per post.

Cost of one-half gallon per post of 1 part concentrated solution of pentachlorophenol to 10 parts oil may be about 12¢ when the concentrated form is purchased in 55 gallon drum quantities at about \$1.75 per gallon and the petroleum oil at about eight cents.

Cost of one-half pound of zinc chloride preservative per post ranges from four to six cents and about one or two cents more for chromated zinc chloride. Borax is very cheap at 4¢ per pound and the simple heating processes described help make it useful. The above preservatives are figured on the basis of purchasing relatively small quantities in drums. Zinc chlorides usually are distributed to farmers in 50 to 100 pound drums. Borax is distributed in 100 pound bags. Distribution of creosote and some salt preservatives is limited in the state at present, but dealers should eventually handle more preservatives at reduced prices if the demand is increased substantially. If a large quantity is to be purchased at one time, it is wise to study the prices of wood preservative producers and freight costs.

Storage of Preservatives

Borax gives off water when exposed to air. Dry forms of zinc chloride or the chromated form, on the contrary, absorb moisture from air. For convenient future use, borax can be stored under shelter in simple packages, paper bags, or other containers. A 50% solution in a wood barrel is the best way to store zinc chlorides.



A fine charcoal made steel bow saw is the best one-man tool to cut small trees and posts.

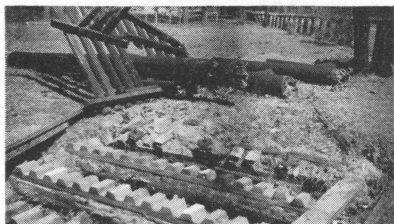
Determining Strength of Solutions

Strength of water solubles recommended for the preservative treating of wood is generally five or ten per cent of the weight of the water and preservatives. For all practical purposes the above five per cent strength is one-half pound of dry chemical dissolved in one gallon of water; and one pound per gallon will be approximately ten per cent strength. Use twice the amount of a 50% solution per gallon: one pound for 5% strength and two pounds per for 10%. The required pound of borax per gallon of water for a ten per cent solution can be dissolved only by heating the water 110 to 125 degrees F. and must be kept warm during the treating period to keep at least ten per cent strength.

Straight creosote (No. 1-A.W.-P.A.) for practical farm use can be diluted with a petroleum oil to one-half strength or for some lumber uses on the farm probably to one third creosote strength.

Penetration of Preservatives

Approximately three fourths or more of the sapwood thickness should be penetrated from the out-



Sapwood with only light surface treatments and placed in or near the ground soon is destroyed inside by decay and termites.

side. According to the end-flow treating table prepared for farm use, sapwoods absorb at least ten pounds, or a little more than one gallon, of a ten per cent water soluble solution to retain the required amount of at least one pound of solid chemical per cubic foot of wood. With deep penetration and sufficient distribution some sapwood species should last ten to 15 years. Species such as sweet gum, having so much sap-water to be displaced by the end-flow method, must absorb at least 20 pounds, or a little more than two gallons, of a five per cent solution to treat thoroughly and retain one pound of solid chemical per cubic foot of wood. About one-third of ten per cent water soluble solutions runs through the sap drip with the end-flow treatment if applied to fresh cut oaks, hickories, or pecan. Therefore, more than the usual required amount of ten per cent solution must be added. The Treating Table of this circular (see Page 23) indicates the minimum amount of ten per cent water soluble solution needed for each diameter size and length of round, fresh-cut post or pole of species to be treated by end-flow. A pole twice the length of a post of the same diameter in the Treating Table will require twice as much solution, thrice the solution for thrice the length and so on. Wood used near the ground and with good air circulation should require only about half the strength of a preservative required for wood in contact with the ground or used in damp places.

Lower the Cost of Preservatives

Cooperative Buying

Farmers save if they buy preservatives in quantities cooperatively. Surpluses can be stored for future use. Cost of treating posts depends, not only on the cost of preservative but also the method used, equipment required, care and workmanship, species of wood, size of posts, depth of penetration and thoroughness of distribution desired. Round wood, as from saplings, will treat more uniformly than sawed or split posts and should last longer.

An average size sapwood post should absorb with the end-flow method about one-half gallon of the oil solvent or at least one-half pound of the solid salt of a water-soluble preservative. Water soluble treatment with the above amount is cheaper than an oil solvent treatment* but the post may not last as long. An average size post to be treated by most farmers should be about 6 or 6½ feet long and three or four inches in diameter inside bark at middle point and it has about one-half cubic feet of wood. This average post for five, ten, or 15 years service life requires two to 20¢ worth of preservative, depending on kind used. If any labor costs are included, about two cents may be added for selecting trees as thinnings for forest improvement and working them up into posts, one to five cents for bark peeling; and one cent or more for hauling,

handling for treatment or applying equipment, and heating. Seasoning if required by methods used, adds about one-half cent to the cost.

Saving the Sap to Mix With More Solution

Some of the preservative chemical may drip out the lower end of the post with the sap if sufficient amount has been used to treat the full length. The amount is negligible for most species having absorptive wood and the sap can be substituted for water with no necessary hydrometer testing of the solution. Approximately one-third will run through coarse grain woods such as oaks, hickories, and pecan. Save the sap drip and add more preservative. A drum soaking solution must be strengthened by adding more preservative after each batch of green posts or any green lumber has been treated.

The hydrometer, an enclosed glass tube with displacement graduations marked on it, is used for testing strengths of automobile battery water or radiator antifreeze. First test a solution of known strength and observe the reading. Then the strength of other solution is measured by simply floating the hydrometer in it. If the solution is strong the hydrometer will float higher than if the solution is weak. A hydrometer also can be made at home with less expense but more trouble.

Use End-Flow Methods for Sapling Posts With Bark On

Round, fresh-cut sapwood posts and poles with the bark left on, especially pines and other soft kinds of woods, can be treated satisfactorily with a water soluble preservative by the end-flow method—applying an ample amount of preservative at only the butt end. Either a section of tire tube, sharpened pipe or cone is attached to an elevated end of the post to hold the preservative solution. By its own head pressure, the solution flows in at the elevated end of the fresh-cut post and pushes the sap out at the lower end. The large

end will absorb more preservative and will be treated best. This end will go into the ground where there must be the best protection against decay and termites. There will be greater assurance of satisfactory treatment if the small ends are given a light end-flow treatment before the butt ends are treated, or if the above-ground-ends are bark-peeled and treated by soaking.

After the wood of most species dries it cannot be treated by the end-flow method. If cut longer than 6 to 12 hours, one inch of the air-dried, shrunk, water tight wood should be sawed off at both ends of the post. If preparations are not complete, posts can be stored under water indefinitely. Exposed ends of fresh-cut willow or cottonwood may shrink water tight within a few minutes on a dry, hot day. Fast growth pines have been treated several days after cutting with a water soluble preservatives and sweet gum and birch may be treatable after several weeks. Most species are treatable a longer period after cutting in the spring time and also treat faster at that time by the end-flow method. Sweet gum and red birch treat rapidly but have a considerable amount of sap to displace and require more water added to the solution. This does not increase the cost of the amount of preservative required. Gum, birch, willow, cottonwood and fast growth pine absorb much concentrated preservatives especially when heated. A cheap preservative, such as borax, should be used liberally with heat.



Pictured here is a sweet gum post with bark left on, thoroughly treated with chromated zinc chloride by end-flow.

According to the Treating Table the time required for the solution to flow into the post range from 6 to 24 hours. Treating periods can be reduced by keeping the preservative heated or by increasing the pressure on the head of the solution.

After the preservative solution has flowed into the post, it is set in the ground along the fence. Bark ordinarily may be left on, but it is important to remove bark from thick bark species to increase their life service. The preservative may occur in streaks in many species immediately after treatment; but when the amount is sufficient it will continue to spread thoroughly in the post if the bark is kept on for about a week. Piling posts horizontally or with tops down and bark on, under a shade is desirable.

Tire Tube for End-Flow Treatment

Sections of tire tubes about two feet long stretched over about two to four inches of barked end have been used when tubes were abundant. Rubber tubes must fit tightly or a wire or cord must be wrapped around the tube to prevent leakage. Air pumped into the tube through the air valve after the open end is closed hastens the flow of solution in proportion to the elastic strength of the expanded tube. The Tire Tube Circular published by the U. S. Forest Products Laboratory of Madison, Wis., describes other important details.

Sharpened Pipes for End-Flow Treatment

Oil boiler flues and other pipes of various diameters can be cut



This farmer drives on a sharpened pipe of proper size to hold the treating solution.

into short pipes and sharpened at one end for treating. Pipes made of rolled sheet metal and welded at the seam last indefinitely if painted inside and out. For this method drive the sharp end of a pipe about one-fourth inch into the end wood with a mallet, just far enough to stand up and prevent leaking. Select a pipe almost as large as the end of a fresh-cut sapling post. Small ends may be treated first with a small pipe using about one-fourth as much preservative. It may be weakened to about five per cent strength for treating the small ends if one of the zinc chlorides are used and more solution if four or five per cent cool water strength of borax is used.

Capped pipes are used to force the preservative through the long poles or small house logs. When driven into the butt ends, the capped pipes can be fastened to the end of long poles with about two or three dog hooks and suspended from brackets welded on the pipe. Dog hooks are made of bolts with a sharp hook formed after cutting off the head and threaded at the other end for tightening

with nuts against the brackets. By this means, the solution can be forced through a hose to the cap from a reservoir elevated 25 to 50 feet or by air pressure on the head of the reservoir solution.

Farmers who plan to treat posts with simple end-flow equipment should have a stock of sharpened pipes about one and a half feet to two feet long of diameter sizes as follows. Five to ten pipes two to three inches; four to eight pipes three and one-half inches; three to six pipes four inches; and some five-inch or larger pipes for treating about six-inch corner and gate posts. Less equipment is needed when only a few posts are treated at a time. Remember to select a pipe that will be smaller than the post to be treated but close to its diameter.

Sharpen the pipe by heating one end in the shop forge and hammering to a rough but fairly long beveled edge for easy driv-



The solution is measured and poured into the cone and pipe receptacles for end-flow treatment.

ing and to prevent cracking the wood. Finish off carefully to good sharpness on a fast cutting grinder without burning the edge. Or have a local machinist turn down an edge on his lathe. Avoid beveling any of the inside metal as it will compress the wood and retard the end-flow. Rubbing grease on the sharpened edge causes the pipe to drive in easier and prevents leakage if the post should crack slightly; also rubbing grease or oil on the sharp edge after the posts are treated preserves the edge for future use.

If the tube or pipe is attached only at the ground end without excessive amounts of preservative, it may not always assure thorough end to end treatment of posts. Small diameter pipes about one foot long facilitate treating the top end of the posts first. When the solution flows in at the butt end, the remaining sap is forced back through the preservative solution already in the small end and pushes out some of the preservative with the drip. This may be saved and tested for strength with a hydrometer and brought up to the desired strength with the addition of more preservative. There will be no necessity for testing cool water solution of borax if used. A strong borax solution used for top end treating will require heating. Borax in the small end may arrest some of the zinc chloride from the butt end treatment which other wise might pass through the post. This method of treatment should be especially adapted to oaks and hickories, except seasoned red oaks can be treated more satisfactorily by end-flow with five per cent pentachlor-

phenol mixture in suitable oil than in a green condition by a water soluble preservative.

Cones for End-Flow Treatment

Cones of tin, pottery, and leak-proof cloth and rubber are used to treat fresh cut sap pole posts of any size. Somewhat similar to a megaphone, the cone should be about two feet long, have a six to eight-inch diameter opening at the large end, and about a one and a half to two-inch opening at the small end. A grease resistant sponge rubber ring is used as a gasket between the cone and post to make the cone watertight. An inch of bark is removed from around the butt end of the post around which the gasket is fitted. The gasket should be smeared with grease before placing it on the end of the post. The large opening of the cone is thrust over the gasket, and if not light is seen by sight-

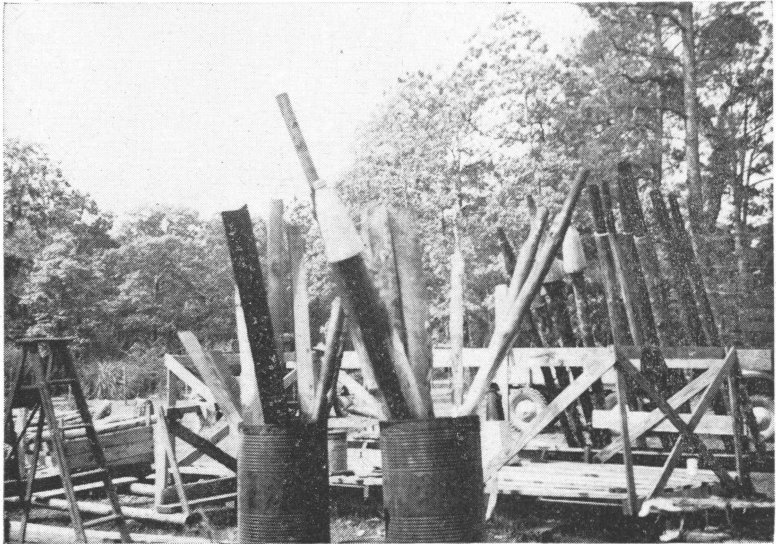
ing through the small top end of the cone it likely will not leak. Required amount of solution is poured in at the top opening. The receptacle portion of the cone above the end of the post usually holds the required amount of preservatives for any common length fence post. The post is stood on end, as in the pipe treating process.

Cones treat faster than pipes, since they allow the preservative to start its inflow over the entire post end area, including the sap ring area. Most sapling species to be treated are too young for heartwood development and the wood, especially at the ground end, may be treated more thoroughly, quickly and easily, by end-flow method using either tire tubes pipes or cones at lowest cost and with most simple equipment than by any other method.

The Soaking Method is Satisfactory for Many Hardwoods and Lumber

The pipe and drum method includes soaking and is better than the single end-flow method for most hardwoods, especially fresh-cut willow and cotton-wood because they peel easily and dry too quickly in hot weather for easy treatment with a water soluble preservative by end-flow alone. Sapwood posts are treated satisfactorily by careful end-flow method and gives good service with the bark left on, but outer wood near top ends sometimes is treated insufficiently and decay or cause the staples to pull out long before the ground ends decay. Some farmers prefer to treat the whole length of bark-peeled posts by soaking in

unheated preservatives for several weeks or by treating with hot and cold baths for several hours for deep and thorough penetration. Decay and termites usually penetrate quickly through checks and cracks of a thin shell of treated outside wood and soon untreated wood beneath is destroyed. Soaking or hot and cool bath methods treat both ends of the posts equally but they do not treat the ground end sufficiently to last as long unless the ground end is given longer treatment. Another objection to the bath treatments is the necessity of keeping a large amount of surplus, low strength preservative in storage when not used. Soaking



The drum on the left is an oil type preservative soaking in the ends of split, sawed, and round seasoned posts. The other drum has a water soluble solution soaking both green and seasoned posts with butt and top ends of some green ones being treated simultaneously. In the background are pipe and cone end-flow treatments with bark on the posts.

for several days is the safest and best method for a pentachlorophenol oil treatment and the wood must be thoroughly peeled and dried.

Bark-Peeled Saplings

End-Flow and soaking treatments used simultaneously are good for fresh-cut and bark-peeled sapwoods. A concentrated borax solution heated in the drum for soaking can be used preferably after the zinc chloride preservatives in the pipes flows in the post. A two and one-half percent pentachlorophenol strength in oil can be used in the drum for treating peeled, seasoned willow, cottonwood, and red oak posts while the butt ends are treating simultaneously with pipe end-flow using probably a five per cent solution of pentachlorophenol in thin oil.

Removing the bark only from the above-ground-end is better for a water soluble preservative soaking in the drum. A week after treatment, remove the remaining bark from the end-flow treated end.

Bark is peeled off by hand tools with less difficulty when the posts are fresh cut from green saplings. The bark is bruised by a few taps of the tool to start peeling. A drawing knife, sharp-shooter spade or straightened hoe is sometimes used. Bark peels more easily in the spring and during early and late hours of cloudy days. No satisfactory simple machine or power driven tool has been developed to remove the bark from posts that are difficult to peel by hand tools.

Drums, Vats, and Other Equipment

Drums or a vat may be needed for treating by soaking posts standing in them and lumber can be treated in long vats. A drum suitable for treating can be made by welding two oil drums end to end with all but the bottom end of the lower drum cut out. A coat of paint should be applied inside and out to prevent rust.

The drum should be placed beneath a tree for at least all non-freezing weather operations. Shade reduces evaporation; the drum can be anchored to the trees; a platform or ladder can be set up easily; a pulley with a rope can be fastened to a limb above to handle hot materials and the entire set-up can be covered for protection against rain.

Drums are made of seasoned tongue and groove lumber similar to silo or water tank construction. They may also be made of two or more joints of large diameter tile. A hole may be dug in the ground and walled up with brick, stone, or cement to serve as a vat. Livestock dipping vats may be used. Drums should be of material that is insulated with emulsified asphalt. A new plastic form of neoprene can be applied with a paint brush for the best method of insulating drums and vats to prevent corrosion and leakage.

Important on the farm is the drum and its water soluble preservative solution because it can be used for treating by the soaking method alone any dry or green lumber, poles, sills, shingles, bark-peeled round, split or seasoned post. A five per cent solution of



These hardwood sapling posts have been thinned for treating.

one of the zinc chloride preservatives is recommended for cool or heated solutions. Lumber and poles, if treated in a drum, should be short enough that at least half of their lengths can be submerged in the drum at one time.

A five per cent solution may penetrate dry wood faster than a stronger solution by the soaking method. Green wood is penetrated faster by soaking in a strong solution. Side penetration is slow through thick summer wood growth bands of heavy woods, such as white oaks, and ash, and faster through pines, gum and red oaks of high sapwood content. Penetration slows up in green or dry woods as it approaches the heartwood and is almost nil into the heartwood of the white oaks, mesquite, cedar, locust, walnut, mulberry, bois d'arc, catalpa, and slow growth pines. Soaking methods, cool or heated, require clean removal of all bark.

With a few simple tools one or more men can work efficiently. If a fine quality steel bow saw is used, one man can quickly fall and cut the small trees into posts. A brush hook axe is handy to trim off limbs, to brush out when necessary and may be used to pry up a heavy pole to prevent pinching in sawing.

A sharp-shooter spade is one of the best tools for bark peeling. Split or sawed posts require the usual tools used for cutting saw logs. A two-man saw or power

saw, an axe, wedges and gluts, bottle of kerosene and a measuring stick are sufficient. Sawed posts require log transport to the saw-mill.

Hot and Cold Bath Treatments Are Thorough and Fast

Hot and cold bath treatment with straight coal tar creosote is the most effective of non-pressure processes. Thoroughness and uniformity of the treatment obtainable most nearly approach that of the pressure processes. (For a good description write for U.S.D.A. Farmers Bulletin No. 744, "The Preservative Treatment of Farm Timber.") Treatment consists of heating dry seasoned wood in the preservative in an open tank for several hours and then quickly submerging it in another drum or vat of cold preservative and allowing it to remain several hours or more. The wood must be transferred within ten minutes or less. One drum or vat can be used allowing the wood and preservative to cool together for several hours.

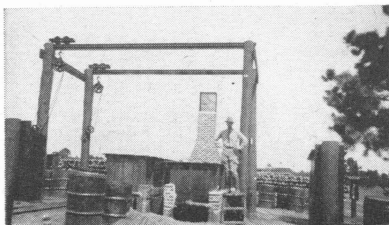
During the hot bath, heating causes the air and moisture in the wood to expand and some to be forced out. When cooling takes place, whether sudden or slow, the air and the small amount of moisture in seasoned wood contract and

a partial vacuum is created, drawing some of the preservative into the wood.

Lengths of Baths

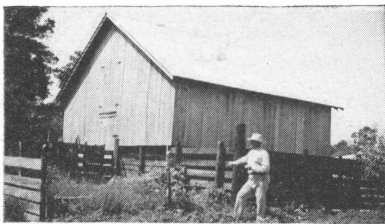
For soaking methods or the hot and cold bath process, a five per cent water soluble preservative ordinary is used for any species. Borax will not dissolve in strengths greater than about four per cent in cool water. The solution should be heated during the treating process if greater strengths are desired. A half day soaking of bark-peeled sapwood fence posts in a cool solution of five per cent zinc chloride only about doubles the service life of the sapwood posts in the ground. A full day soaking allows most preservatives to penetrate many kinds of sapwood about one-fourth inch which is not deep enough for posts.

A longer soaking period of green or seasoned wood in a cool solution is desirable for deep penetration; one to three weeks, depending on the resistance of the wood to treatment, and kind of preservative may be necessary if the expected life of a post is to be 10 to 15 years or more. Pine post woods and others with low-treating resistance may last two or three times longer than untreated posts with 48 hours soaking in five per cent pentachlorophenol cool solution. Deep and thorough penetration from end to end of the posts and with longer



Hot and cold vats, reinforced and welded at the seams, are used for treating posts.

period of butt treatment can be obtained by either the long time soaking, two-end pipe treatment, pipe and drum method, of hot and cold baths which are the surest of the simple treatments for most hardwoods. Hot and cold baths are the best straight creosote treatments for seasoned wood. Pentachlorophenol in thin oil was found to penetrate seasoned willow and red oaks rapidly and thoroughly by end-flow methods used with electric light bulb heating. End-flow with this preservative was found too slow in seasoned pine, gum, cedar, post oak, and other white oaks.



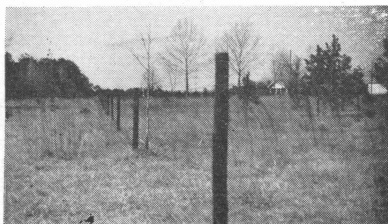
Carl Mueller's hog barn and pen lumber was grown and sawed on his Harris County farm, and afterwards hauled to a nearby creosoting plant for pressure treating.

Length of hot and cold baths must be governed by the ease with which timber takes treatment, its size, and depth of penetration desired. Well-seasoned timber is moderately easy to treat. A hot bath of one to three hours and a cold bath of the same duration or longer are sufficient for fence posts of moderate treatability. Woods easy to treat require less time. In using straight coal tar creosote, a deep penetration should be obtained with minimum amount of preservative. Coal-tar creosote is expensive. Heating as well as cooling baths are shorter for smaller posts or other wood of

small dimension. To reduce absorption an "Expansion" bath at 200 degrees F. to 220 degrees F. for an hour or two is advised. The oil and air in the wood are expanded by reheating and thus some surplus oil is recovered in the second hot bath. Expansion baths leave the wood cleaner than when directly removed from cold oil. Post oak or other white oaks are highly resistant to treatment and permit only sapwood penetration. It is good economy to treat only the ground end of these moderately durable species. Penetration should reach the center of small sapwood posts, especially at the ground ends.

Telephone, Telegraph and Power Line Poles

Chief use of hot and cold baths has been in treating the butts of moderately durable fence posts and telegraph, telephone, and power line poles. Coal-tar creosote is the preservative ordinarily chosen because it is the most suitable to be heated to high temperatures. Zinc chloride or chromated zinc chloride solutions are satisfactory if kept at a uniform strength. Wood need not be as well seasoned for bath treatments with water soluble preservatives.



Small pine posts treated with straight creosote by hot and cold baths assure long service.

With straight coal-tar creosote, hot bath temperatures up to 230 degrees F. may be used without much loss by evaporation, but temperatures of 210 degrees F. are sufficient. For cedar poles and posts, 230 degrees F. is specified. In cold baths 100 degrees F. is

usually about right. This temperature keeps the oil fluid but much cooler than hot baths. Preservatives with petroleum oils in mixture may soon boil over a low drum when heat exceeds 100 to 125 degrees and loss by evaporation is excessive.

Heat Speeds All Treatments

Keeping the drum soaking solution warm while treating speeds up penetration and helps with any water soluble preservatives that are not injured. A strong borax solution, greater than five per cent may be used warm to hot in the steeping method. Preservatives are made more fluid and most of them more solvent by heat. In cold weather the preservative and the wood must be kept warm by treating in a warm room or by continuous heating of the preservative. Make the heating process safe against any danger from fire.

Burning waste wood along a pipe which pierces each drum will heat two drums. An old gas burning water heater with sufficient diameter with or without thermostatic heat control for gas or oil fuel makes an ideal heating drum. Vats can be walled up with brick to be heated beneath with a fire box at one end and chimney at the other.

Heating in water facilitates the removal of bark. After the bark is peeled off, the posts are replaced in the drum with a water soluble preservative solution to complete the treatment.

Heating a strong borax solution is practical for any green, bark-

peeled fence post treated by the pipe and drum method, with further assurance that both ends give long service. Drum solutions should be five per cent zinc chloride or ten per cent borax with heat. Do not mix the two solutions.

Pipe solution of required amount according to the Treating Table for simultaneous end-flow treatment should be chromated zinc chloride of ten per cent strength. The two-chemical treatment will be faster, more effective with more absorptive woods if the end-flow treatment is allowed to reach completion before the post is steeped in hot borax solution. It is better for oaks and hickories to begin soaking during the end-flow process. Strong borax treatment of the ground end will assure termite and decay resistance for about ten years for all posts and longer if leaching can be checked. Posts of least resistance treated with pipe and drum methods and with the preservative heated in drum need not remain longer than the time required for ample pipe solution to flow into the post.

Hot solution in pipes can be maintained for the end-flow treatment by inserting a switched-on electric light bulb and is important for treating with borax. Long tab-

ular types of bulbs insert easily into small pipes. An electric glass bulb handled carefully and safely is the most efficient heating method known. For further information on soaking wood in cool or heated

preservatives write for: "For Preservation of Timber by the Steeping process" and "Treating Wood in Pentachlorophenol Solutions by Cold—Soaking Method" by the U. S. Forest Products Laboratory.

Apply Final Treatments for Wood

Life of posts is increased by painting both ends and a band at the ground level with pitch or tar or other good paint after the posts have been treated with water soluble preservatives. Treated posts last much longer if they are air dried a few weeks, then soaked long enough or warmed in less time in petroleum oil to seal the water soluble preservative in the wood. Use care for oils heated above 100 degrees F. foam over a low drum and spread fire.

Coating with Paint

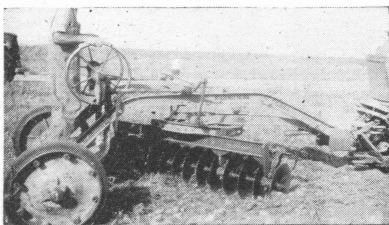
Any necessary cutting, sawing, drilling, or other work on good materials made after they have been treated should have the exposed part brush-treated one or more times with creosote or an oil soluble preservative to prevent entrance of decay organisms or any wood destroying insects. Coated with paint, varnish or oil the entire surfaces of water soluble preservative treated wood after thorough drying often is good economy. This will retard moisture absorption and leaching of the preservative. This protection coating also reduces weathering, checking, warping and swelling. Thorough air drying alone of treated or untreated wood materials and keeping them dry in use with adequate ventilation will increase lasting qualities of wood for uses in some

construction and also will reduce warping and swelling. Paint alone, on untreated wood, may sometimes hasten decay if it prevents drying and drainage of moisture. Decay usually starts at the joining points of lumber in construction where moisture collects and it is more important to treat there than elsewhere. For example, dobbing a gate with creosote at the contact points will not cost much and will add years to its service.

Fire Proofing Posts

Fire underwriters classify wood impregnated with three pounds of chromated zinc chloride per cubic foot as 31 in relation to asbestos as O and untreated oak as 100 when subjected to fire retarding tests. Flame spread of treated wood is less than one-half that of untreated wood.

With as light a treatment as one pound of the chromated zinc chloride preservative per cubic



A shop made disc attachment to a road machine is used by a county highway department for cultivating roadside trees and simultaneously making fire lanes.

foot, such as recommended for treating fence posts, flame spread of treated wood is less than one-half that of untreated wood. There has been no test to determine grass fire retarding of posts treated with any preservative or quantity of it. Borax as well as the zinc chlorides are used in fire retarding treatments of wood.

Water soluble preservatives are safe, clean, odorless, and cheap enough for good home treatments. There is no simple, low-costing

treatment method that will apply generally to every kind of wood for all farm uses and conditions. Nevertheless, farmers using good common sense and knowing the specific requirements can choose a suitable method to make post and wood treating a practical operation. Except for thin attractive barks on birch, sycamore, eucalyptus or aspen, most posts should not have bark if they are to be sold. Posts for sale should be uniform as to size, treatment, and species.

Treating Table for End-Flow Methods

This table shows proper amounts of ten per cent solution (mixed one pound per gal. of water) of zinc chloride or preferably chromated zinc chloride to use for treating round, fresh-cut sapwood posts of different sizes by any of the end-flow methods. Bark is removed only for some combination treatments. Make solution in convenient quantities, using a quart cup to measure and pour. Learn to estimate the middle diameter inside bark and length of posts. See directions on use of borax and oils below.

Example—How to Use the Table and Treat a Post: Assume post has middle diameter of 4 inches and a length of 7 feet. To the right of 4 in the Inch column and under gallons in the 7-foot column, the amount required is $\frac{3}{4}$ of a gallon, or three quarts. Pour into a sharpened pipe receptacle driven into the butt end and stand against a support for 12 to 24 hours for all solution to flow in. Remove the pipe and place the post in the fence.



The tire tube end-flow treatment is applied to the posts.

Below are approximate amounts of solution for posts that are:

Diam. Inches	6 feet long		7 feet long		8 feet long		10 feet long		12 feet long	
	Lbs.	Gals.	Lbs.	Gals.	Lbs.	Gals.	Lbs.	Gals.	Lbs.	Gals.
3	3	$\frac{1}{4}$	$3\frac{1}{2}$	$\frac{1}{2}$	4	$\frac{1}{2}$	5	$\frac{1}{2}$	6	$\frac{3}{4}$
$3\frac{1}{2}$	4	$\frac{1}{2}$	$4\frac{3}{4}$	$\frac{1}{2}$	$5\frac{1}{4}$	$\frac{1}{2}$	$6\frac{3}{4}$	$\frac{3}{4}$	8	1
4	$5\frac{1}{4}$	$\frac{1}{2}$	6	$\frac{3}{4}$	7	$\frac{3}{4}$	$8\frac{3}{4}$	1	$10\frac{1}{2}$	$1\frac{1}{4}$
$4\frac{1}{2}$	$6\frac{3}{4}$	$\frac{3}{4}$	$7\frac{3}{4}$	$\frac{3}{4}$	$8\frac{3}{4}$	1	11	$1\frac{1}{4}$	$13\frac{1}{4}$	$1\frac{1}{2}$
5	$8\frac{1}{4}$	1	$9\frac{1}{2}$	1	11	$1\frac{1}{4}$	$13\frac{3}{4}$	$1\frac{1}{2}$	$16\frac{1}{4}$	$1\frac{3}{4}$
$5\frac{1}{2}$	10	1	$11\frac{1}{2}$	$1\frac{1}{4}$	$13\frac{1}{4}$	$1\frac{1}{2}$	$16\frac{1}{2}$	$1\frac{3}{4}$	$19\frac{3}{4}$	$2\frac{1}{4}$
6	$11\frac{3}{4}$	$1\frac{1}{4}$	$13\frac{3}{4}$	$1\frac{1}{2}$	$15\frac{3}{4}$	$1\frac{3}{4}$	$19\frac{3}{4}$	$2\frac{1}{4}$	$23\frac{1}{2}$	$2\frac{1}{2}$
$6\frac{1}{2}$	$13\frac{3}{4}$	$1\frac{1}{2}$	$16\frac{1}{4}$	$1\frac{3}{4}$	$18\frac{1}{2}$	2	23	$2\frac{1}{2}$	$27\frac{3}{4}$	3
7	16	$1\frac{3}{4}$	$18\frac{3}{4}$	2	$21\frac{1}{2}$	$2\frac{1}{4}$	$26\frac{3}{4}$	3	32	$3\frac{1}{2}$
$7\frac{1}{2}$	$18\frac{1}{2}$	2	$21\frac{1}{2}$	$2\frac{1}{4}$	$24\frac{1}{2}$	$2\frac{3}{4}$	$30\frac{3}{4}$	$3\frac{1}{4}$	$36\frac{3}{4}$	4
8	21	$2\frac{1}{4}$	$24\frac{1}{2}$	$2\frac{3}{4}$	28	3	35	$3\frac{3}{4}$	42	$4\frac{1}{2}$
$8\frac{1}{2}$	$23\frac{3}{4}$	$2\frac{1}{2}$	$27\frac{1}{2}$	3	$31\frac{1}{2}$	$3\frac{1}{2}$	$39\frac{1}{2}$	$4\frac{1}{4}$	$47\frac{1}{4}$	$5\frac{1}{4}$
9	$26\frac{1}{2}$	3	31	$3\frac{1}{2}$	$35\frac{1}{4}$	4	$44\frac{1}{4}$	$4\frac{3}{4}$	53	$5\frac{3}{4}$
$9\frac{1}{2}$	$29\frac{1}{2}$	$3\frac{1}{4}$	$34\frac{1}{2}$	$3\frac{3}{4}$	$39\frac{1}{2}$	$4\frac{1}{4}$	$49\frac{1}{4}$	$5\frac{1}{2}$	59	$6\frac{1}{2}$

Use of borax for end-flow treatments is experimental but may meet the farmers' need for a good five-cent post. For a light treatment use twice the amount given in the table above for each post of a four or five per cent saturated strength of borax in cool water. If oaks and hickories are treated add one-half more of the ten per cent solution to the table amount of any above preservatives for each post and save the sap drip. If sweet gum or other absorptive wood is treated, use about twice as much preservative of a five per

cent strength to each post to displace all of the free sap. If small ends are treated by end-flow before the butt ends are treated, use about one-fourth of the table amount and add more water for more absorptive species. Use all of the table amount for treating butt ends. For seasoned willow, cottonwood and red oaks, use about one-half the table amount of a five per cent pentachlorophenol strength with a penetrating oil in butt pipe and the same amount of a two and one-half per cent strength in the top end pipe.

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